

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

9608
R26

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO

A
BETTER IRRIGATION
OF
WARTIME CROPS.



LIBRARY
CURRENT SERIAL RECORD

OCT 30 1943

U. S. DEPARTMENT OF AGRICULTURE

BY

JOHN G. BAMESBERGER

REGIONAL BULLETIN NO. 88
ENGINEERING SERIES NO. 7

#2882

MAY 1943

BETTER IRRIGATION OF WARTIME CROPS

THERE IS ONLY ONE RIGHT WAY TO IRRIGATE AND THAT IS TO PUT WATER INTO THE SOIL TO THE DEPTH OF PLANT ROOTS AND NO DEEPER.

TO ACHIEVE GOOD IRRIGATION, THREE BASIC RULES SHOULD BE FOLLOWED: (1) KNOW WHERE THE WATER IS GOING, (2) HAVE THE WATER UNDER CONTROL AT ALL TIMES, AND (3) HAVE AN IRRIGATION LAYOUT THAT FITS YOUR LAND AND YOUR CROPS.

REGARDLESS OF WHAT METHOD OF IRRIGATION YOU MAY USE--WHETHER IT BE THE FURROW, BORDER, CORRUGATION, BASIN, WILD FLOODING OR SPRINKLING SYSTEM--- YOU CAN DO AN EFFICIENT JOB IF YOU FOLLOW THOSE THREE RULES.

EVERY FARMER KNOWS--OR SHOULD KNOW--THAT IRRIGATION IS THE MOST IMPORTANT JOB ON HIS FARM. IRRIGATION HAS MORE EFFECT ON CROP YIELDS AND ON PROFITS OR LOSSES THAN ANY OTHER SINGLE PART OF FARMING. FOR THAT REASON, IT DESERVES CAREFUL THOUGHT AND PLANNING. THIS IS ESPECIALLY TRUE IN WARTIME, WHEN THE NATION CAN ILL AFFORD INEFFICIENT CROP PRODUCTION PRACTICES.

RULE NO. 1: KNOW WHERE THE WATER IS GOING

KNOW HOW MUCH WATER IS SOAKING INTO THE SOIL --HOW DEEP IT IS PERCOLATING THROUGHOUT THE LENGTH OF THE RUN--HOW MUCH IS RUNNING OFF THE LOWER END OF THE FIELD AS WASTE.

THE OBJECTIVE OF IRRIGATION IS TO FURNISH MOISTURE REQUIRED TO GROW CROPS. THEREFORE, IT IS WASTEFUL TO APPLY MORE WATER THAN CROPS CAN USE OR

TO LET WATER PERCOLATE SO DEEP THAT THE ROOTS CANNOT REACH IT. THE ONLY EXCEPTION TO THE RULE THAT WATER SHOULD NEVER PERCOLATE DEEPER THAN THE ROOT ZONE IS ON ALKALI LAND, WHERE AN OCCASIONAL EXTRA HEAVY IRRIGATION MAY BE NEEDED TO LEACH OUT THE ALKALI.

SOIL CAN HOLD ONLY A CERTAIN AMOUNT OF WATER, USUALLY FROM 15 TO 30 PERCENT OF ITS VOLUME AFTER IT HAS DRAINED FOR A DAY OR SO. IF YOU APPLY AN EXCESS OF WATER, IT DOES NOT STAY IN THE ROOT ZONE, WAITING FOR THE PLANTS TO USE IT. INSTEAD, IT PERCOLATES DEEPER, DOWN BELOW THE ROOT ZONE, OR IT STRIKES AN IMPERVIOUS LAYER OF SOIL AND IS HELD UP AS A WATER TABLE.

SOME PEOPLE BELIEVE THAT YOU CAN MAKE CROPS SEND ROOTS JUST AS DEEP AS THE WATER PENETRATES. THAT IS NOT TRUE. PLANTS HAVE DEFINITE ROOTING HABITS, AND IT IS GENERALLY KNOWN HOW DEEP THEY WILL SEND THE MAJORITY OF THEIR ROOTS IN DIFFERENT KINDS OF SOIL. SOILS, MORE THAN ANYTHING ELSE, DETERMINE THE DEPTH OF ROOTS. A DEEP, LIGHT SOIL WILL INDUCE LONGER ROOT GROWTH THAN A HEAVY SOIL.

NO MATTER HOW MUCH WATER YOU PUT BELOW THE NORMAL ROOT ZONE FOR YOUR CROPS AND SOIL, YOU STILL WILL FIND VERY FEW ROOTS DOWN THERE. IF, HOWEVER, YOU ARE NOT IRRIGATING DEEP ENOUGH FOR NORMAL ROOT GROWTH, THE ROOTING HABITS AND PLANT GROWTH WILL BE AFFECTED.

WATER WHICH PERCOLATES BELOW ROOTS MAY DO HARM TO YOUR CROPS AND SOIL. SOLUBLE PLANT FOODS, SUCH AS NITRATES, MAY BE WASHED DOWN TOO DEEP TO BE USED BY THE PLANTS, THE STRUCTURE OF YOUR SOIL MAY BE BROKEN DOWN, OR PROPER AERATION MAY BE PREVENTED.

FURTHERMORE, IF A FARMER WISHES TO SAVE WATER, HE CANNOT IRRIGATE BY THE CALENDAR. HE MUST PUT WATER ON THE LAND ONLY WHEN THE PLANTS NEED IT. YOUNG CROPS WILL NEED LIGHT, FREQUENT IRRIGATIONS, BUT MATURE CROPS WILL REQUIRE HEAVIER, LESS FREQUENT IRRIGATIONS. IN THE HOT SUMMER, PLANTS NEED TO BE IRRIGATED MORE OFTEN THAN IN THE COOL FALL.

IRRIGATING YOUNG CROPS AS HEAVILY AS MATURE ONES, OR IRRIGATING IN THE COOL SEASONS IN THE SAME WAY AS IN THE SUMMER, WILL ONLY RESULT IN WASTING WATER THROUGH PERCOLATION. TO AVOID THIS WASTE, THE FARMER SHOULD USE HIS SHOVEL OR A SOILS AUGER TO FIND OUT HOW FAR DOWN THE PLANTS HAVE USED UP THE AVAILABLE MOISTURE. THEN HE SHOULD PUT ON JUST ENOUGH WATER TO WET THE GROUND TO THIS DEPTH AND NO DEEPER. HIS OBJECTIVE IS TO MAKE THE TOP AND BOTTOM MOISTURE MEET.

WATER THAT IS WASTED, EITHER BY DEEP PERCOLATION OR BY RUNNING OFF THE LOWER END OF THE FIELD, COSTS JUST AS MUCH AS WATER THAT IS USED. TOO MUCH WATER WILL USUALLY DECREASE CROP YIELDS, AND IT IS CERTAINLY TAKING MONEY OUT OF YOUR POCKET IN LARGER WATER BILLS.

A MOISTURE PROBE SHOULD BE USED TO DETERMINE HOW DEEP THE WATER IS PERCOLATING. THE PROBE IS NOTHING MORE THAN A $1/2$ INCH OR $3/8$ INCH ROD 4 FEET LONG WITH A HANDLE ON ONE END. THE DEPTH OF MOISTURE PENETRATION IS DETERMINED BY THE EASE WITH WHICH THE PROBE IS PUSHED DOWN THROUGH THE SOIL.

WHEN FIRST STARTING TO USE A PROBE, YOU SHOULD CHECK RESULTS BY ALLOWING THE SOIL TO DRAIN FOR ABOUT TWO DAYS AND THEN DIGGING HOLES OR USING A SOIL AUGER TO DETERMINE JUST HOW DEEP THE MOISTURE FINALLY PENETRATED. IT WILL REQUIRE ONLY A

FEW CHECKS TO SHOW, FOR EXAMPLE, THAT IF THE PROBE SHOWS THREE FEET OF SATURATION, THE MOISTURE WILL PERCOLATE TO A 4-FOOT DEPTH. ONCE THIS IS DETERMINED FOR DIFFERENT DEPTHS AND FOR EACH TYPE OF SOIL, THERE IS NO MORE NEED FOR TEST HOLES.

RULE NO. 2: HAVE THE WATER UNDER CONTROL

CONTROL OF WATER MEANS NOT ONLY CONTROL IN THE HEAD DITCHES BUT ALSO GOOD ENOUGH CONTROL AT EACH FURROW OR CORRUGATION OR TURNOUT, OR OTHER OUTLET, TO ENABLE YOU TO MAKE QUICK, ACCURATE, AND LASTING ADJUSTMENTS AT EACH STREAM OF WATER.

SOME SORT OF ADJUSTABLE GATE BOXES, TURNOUT BOXES, OR A COMBINATION OF THE TWO, SHOULD BE PROVIDED IN THE HEAD DITCHES AND AT EVERY POINT WHERE WATER IS DIVERTED. WOODEN STRUCTURES HAVE PROVED SATISFACTORY AND HAVE THE ADDED ADVANTAGE OF BEING PORTABLE.

FOR CORRUGATION AND FURROW IRRIGATION, YOU CAN CONTROL THE WATER MORE EASILY BY USING AN EQUALIZING BASIN. THIS IS A SMALL, SHORT SECTION OF DITCH PARALLEL TO THE HEAD DITCH. WATER IS RUN FROM THE HEAD DITCH INTO THIS BASIN AND FROM THE BASIN INTO THE FURROWS. WHEN WATER IS RUN DIRECTLY FROM THE HEAD DITCH INTO THE FURROWS, EVERY CHANGE OF WATER LEVEL IN THE HEAD DITCH WILL REQUIRE A CHANGE IN THE SETTING FOR EACH FURROW, IF YOU EXPECT TO ACHIEVE EFFICIENT IRRIGATION. WHEN EQUALIZING BASINS ARE USED, THE WATER LEVEL IN THE BASIN CAN BE CONTROLLED BY ADJUSTING THE GATE BETWEEN IT AND THE HEAD DITCH.

GENERALLY, THE MOST NEGLECTED AND THE WEAKEST POINT OF WATER CONTROL IS AT THE PLACE WHERE IT IS BEING PUT ON THE LAND. IN BORDER, BASIN, OR

WILD FLOODING IRRIGATION, THE FLOW IN THE HEAD DITCH FREQUENTLY IS DIVIDED BETWEEN SEVERAL TURN-OUTS. THE MOST COMMON PRACTICE IS TO CUT A HOLE IN THE DITCH BANK AND USE GRAVEL, WEEDS, SACKS, TAR PAPER, OR SOMETHING OF THAT NATURE, IN AN EFFORT TO KEEP THE HOLE FROM CUTTING LARGER.

THESE DEVICES SELDOM WORK, AND, SOONER OR LATER, ONE OUTLET IS TAKING MOST OF THE WATER. FURTHERMORE, THERE IS NOTHING BUT THE IRRIGATOR'S EYE TO JUDGE WHETHER EQUAL FLOWS ARE BEING DIVERTED. IT IS PRACTICALLY IMPOSSIBLE TO GET UNIFORM AND EFFICIENT DISTRIBUTION OF WATER UNLESS GATES, TURN-OUT BOXES, SPILES, OR OTHER CONTROLS ARE USED.

RULE No. 3: HAVE A WELL-PLANNED IRRIGATION LAYOUT

WE HAVE STATED THAT YOU SHOULD KNOW WHERE THE WATER IS GOING AND HAVE THE WATER UNDER CONTROL AT ALL TIMES. IN ADDITION, YOU SHOULD HAVE A GOOD FIELD LAYOUT, WITH PROPER LENGTH OF RUNS, PROPER WIDTH OF BORDERS, PROPER SPACING OF FURROWS AND CORRUGATIONS, DROP STRUCTURES IN YOUR CANALS TO PREVENT EROSION, AND SO ON.

THE COMMONEST ERROR IN FIELD LAYOUTS IS HAVING RUNS THAT ARE TOO LONG. LENGTHS OF RUNS ARE PARTLY GOVERNED BY THE AVAILABLE GRADE AND THIS IS GENERALLY PRETTY WELL FIXED, ALTHOUGH THERE ARE PLACES WHERE IT CAN BE ALTERED BY CHANGING THE DIRECTION OF IRRIGATION OR BY GRADING. SOME OTHER FACTORS AFFECTING LENGTH OF RUN ARE ERODIBILITY OF SOILS, RATE OF INTAKE OF WATER, AMOUNT OF WATER AVAILABLE, CROPS TO BE GROWN, AND THE LABOR AVAILABLE FOR IRRIGATING.

SINCE IT IS IMPOSSIBLE TO SET UP A TABLE OR A FORMULA FOR PROPER LENGTH OF RUNS FOR ALL FIELDS,

YOU SHOULD DETERMINE THIS BY TRIAL IRRIGATION. PLOW OUT A FEW FURROWS OR PREPARE ONE BORDER FOR IRRIGATION. IF THERE IS A CHOICE OF GRADES, TRY SEVERAL IN ADDITION TO THE ONE WHICH APPEARS TO BE MOST DESIRABLE. THEN IRRIGATE WITH THE LARGEST HEAD OF WATER THAT CAN BE USED WITHOUT CAUSING EROSION.

BY USING A MOISTURE PROBE, YOU CAN DETERMINE THE DISTANCE YOU CAN RUN THE WATER AND STILL OBTAIN FAIRLY UNIFORM PENETRATION. THIS DISTANCE SHOULD BE THE LENGTH OF THE RUN. IT IS A GOOD IDEA TO CHECK THIS BY LAYING OUT ANOTHER SET OF FURROWS OR ANOTHER BORDER WITH RUNS JUST AS LONG AS WAS INDICATED IN THE FIRST TRIAL. THEN IRRIGATE AS EFFICIENTLY AS YOU KNOW HOW AND ONCE AGAIN DETERMINE THE LENGTH OF EVEN PENETRATION.

GOOD IRRIGATION IS NOT DIFFICULT

GOOD IRRIGATION APPEARS COMPLICATED BECAUSE EACH FIELD IS DIFFERENT. IF YOU CONSIDER ONE FIELD AT A TIME, HOWEVER, IT IS REALLY FAIRLY SIMPLE AND EVERY FARMER CAN OBTAIN GOOD RESULTS WITH LITTLE HELP. MANY FARMERS IN THE SOUTHWEST HAVE CUT THEIR WATER BILLS AS MUCH AS 20 PERCENT, RAISED BETTER CROPS, AND KEPT THEIR SOIL FROM WASHING AWAY BY APPLYING IRRIGATION WATER MORE EFFICIENTLY.

IRRIGATION IS A FULL-TIME JOB WHICH SHOULD NOT BE NEGLECTED, AND IT SHOULD BE REMEMBERED THAT PUTTING A SHOVEL INTO A MAN'S HAND DOESN'T AUTOMATICALLY MAKE HIM A GOOD IRRIGATOR.

FOR ADDITIONAL ADVICE ON IRRIGATION PROBLEMS, YOU ARE ADVISED TO CONSULT WITH YOUR COUNTY AGENT, AAA COMMITTEEMAN, SUPERVISORS OF A SOIL CONSERVATION DISTRICT, OR A DISTRICT CONSERVATIONIST OF THE SOIL CONSERVATION SERVICE.

WHEN TILLAGE BEGINS, OTHER ARTS FOLLOW.

THE FARMERS THEREFORE ARE THE FOUNDERS
OF HUMAN CIVILIZATION.

--DANIEL WEBSTER